(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 March 2002 (07.03.2002)

PCT

(10) International Publication Number
WO 02/19392 A1

(51) International Patent Classification[7]: H01L 21/00

(21) International Application Number: PCT/EP00/08560

(22) International Filing Date:
1 September 2000 (01.09.2000)

(25) Filing Language: English

(26) Publication Language: English

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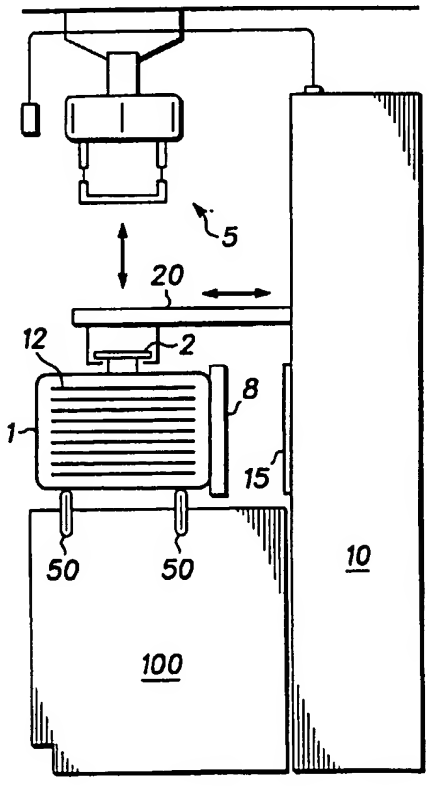
(81) Designated States *(national)*: CN, JP, KR, US.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A METHOD AND DEVICE FOR DOCKING A SUBSTRATE CARRIER TO A PROCESS TOOL



(57) Abstract: The invention provides a method and device for docking a substrate carrier (1) to a process tool (10), said substrate carrier (1) comprising a case having a front door (8) to be docked to a front door (15) of said process tool in a hermetically sealed manner by using a clamping means (20, 20') for clamping said substrate carrier (1) and urging it against said process tool (10), and having interposed a seal (7) between said substrate carrier (1) and said process tool (10); and said clamping means (20, 20') clamping said substrate carrier (1) at either or both of a top flange (2) and a bottom retaining feature (17a, 17b; 18; 19).

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A METHOD AND DEVICE FOR DOCKING A SUBSTRATE CARRIER TO A PROCESS TOOL

Field of the Invention

The present invention generally relates to a method and device for docking a substrate carrier to a process tool.

Background of the Invention

In semiconductor technology, some process tools require a hermetic or nearly hermetic seal between the process tool and a substrate carrier (for the 300 mm generation of process tools this carrier is also called Front Opening Unified Pod or shortly FOUP). These process tools include furnaces that require minimal exposure of the loadlock to the atmosphere as well as tools that utilize a nitrogen purge for said substrate carrier. In nitrogen purge applications, the substrate carriers can either be purged from nitrogen purge sockets located on the base of the substrate carrier or through the use of a nitrogen purge through the substrate carrier front door opening.

FIG. 1 illustrates a known device for docking a substrate carrier to a process tool. In FIG. 1, reference sign 1 denotes a wafer substrate carrier containing a plurality of wafer substrates 12. 2 denotes a top flange for attaching a lifting means 5 for lifting said substrate carrier 1 to another location. 11 denotes the bottom of said substrate carrier 1, and 50 a conveyor means for conveying said substrate carrier 1 in the horizontal plane. 8 denotes the front door of the substrate carrier. 10 denotes a process tool, here an oven, to which the substrate carrier 1 is to be docked in a hermetically sealed manner by using a clamping means 200. In addition,

the carrier 1 is also clamped to loadport 100 using another clamping means 501. All loadports have such clamping means 501 for holding the carrier 1. This clamping means 501 is intended to prevent an operator from removing the carrier while the wafers are being processed.

Preferably, an hermetic seal in form of a compliant rubber cushion surrounds the front door 8 of the substrate carrier 1. Moreover, on the side edges of the front side, there is a lip around the door 8. The clamping means 200 which is connected to the front side of the process tool 10 engages with the lip in order to clamp said substrate carrier 1 and urge it against said process tool 10 for forming a sealed connection between both of them.

Once such a hermetically sealed condition has been established, the front door 8 of the substrate carrier 1 is opened by latch keys on the front door of the process tool 10, and a wafer substrate handling mechanism (not shown) transports the wafer substrates 12 stored in said wafers substrate carrier 1 into said process tool 10 for thermal processing.

Unfortunately, these front door features which are suited for connecting to the clamping means are not standardized in thickness or size, and it is also possible for obstructions to be on the lip, e.g. the latch holes are on the door lip. This has resulted in tool loadport designs that must be changed as one changes the substrate carrier manufacturer and thus invalidates the concept of having interchangeable substrate carrier and loadport designs. All known prior art operators use the substrate carrier front frame to clamp and press. Thus the prior art fails by preventing the usage of substrate carriers from different suppliers or designs to the same time in the manufacturing line.

The present invention seeks to provide to a method and device for docking a substrate carrier to a process tool which mitigate or avoid these and other disadvantages and limitations of the prior art.

Brief Description of the Drawings

FIG. 1 illustrates a known device for docking a substrate carrier to a process tool

FIG. 2 illustrates a first embodiment of a device for docking a substrate carrier to a process tool;

FIG. 3 illustrates a second embodiment of a device for docking a substrate carrier to a process tool;

FIG. 4 illustrates a bottom view of the substrate carrier of the second embodiment shown in FIG. 2;

FIG. 5 illustrates magnified view of the front door section of the substrate carrier and the process tool of FIGS. 3; and

FIG. 6 illustrates a simplified flow-chart diagram of a method for docking a substrate carrier to a front door of a process tool in an hermetically sealed manner.

Detailed Description of a Preferred Embodiment

In accordance with one aspect of the present invention, a method for docking a substrate carrier to a process tool is provided, said substrate carrier comprising a case having a front door to be docked to a front door of said process tool in a hermetically sealed manner by using a clamping means for clamping said substrate carrier and urging it against said process tool, and having interposed a seal between said substrate carrier and said process tool; and said clamping means clamping said

substrate carrier at either or both of a top flange and a bottom retaining feature.

In accordance with another aspect of the present invention, a device for docking a substrate carrier to a process tool is provided, said substrate carrier comprising a case having a front door to be docked to a front door of said process tool in a hermetically sealed manner, said device comprising a clamping means for clamping said substrate carrier and urging it against said process tool, and a seal between said substrate carrier and said process tool; said clamping means being designed for clamping said substrate carrier at either or both of a top flange and a bottom retaining feature.

The general idea underlying the present invention is to utilize a clamping means to a standardized substrate carrier feature, particularly the top robotic flange or the bottom kinematic coupling plate, with which the substrate carrier is pressed against the seal located at the load port. Advantageously, the present invention solves the problem of having to change tool and loadport design as one changes from one substrate carrier manufacturer to another.

In the case of a clamp to the bottom kinematic coupling plate, it is possible that additional force may be applied to ensure that the substrate carrier remains firmly seated on the load ports kinematic coupling pins. This can for example be achieved by having said clamping means clamping at both of said top flange and said bottom plate.

According to a preferred embodiment, said bottom retaining feature comprises at least one of a bottom recess and a bottom conveyor rail hole.

According to another preferred embodiment, said substrate carrier is for carrying semiconductor wafer substrates.

According to another preferred embodiment, said top flange is also used for attaching a lifting means for lifting said substrate carrier.

According to another preferred embodiment, said seal surrounds said front door of a process tool loadport.

Throughout the figures, the same reference signs denote the same or equivalent parts.

FIG. 2 illustrates a first embodiment of a device for docking a substrate carrier to a process tool.

In FIG. 2, reference sign 100 denotes a loadport to a process tool 10 in form of a furnace. The wafer substrate carrier 1 containing the wafer substrates 12 has been brought forward to the loadport by the conveyor means 50. Before, the wafer substrate carrier 1 has been set onto the conveyor means 50 by the lifting means 5 which engages with the top flange 2.

Now, in this position, the clamping means 20 provided at the loadport and connected to the process tool 10 is moved to the top flange 2 of the substrate carrier 1 and clamped thereon (cf. 310 in FIG. 6). In a next step, (cf. 320 in FIG. 6), the clamping means 20 will be retracted to the process tool 10 and therefore means 20 pulls the wafer substrate carrier 1 with its front door 8 to the front door 15 of the process tool 10. Then, the hermetic seal 7 surrounding the front door 15 of the process tool 10 (also cf. FIG. 4) is urged against the front wall of the substrate carrier 8 in order to establish hermetically sealed state. In this state, the door 8 of the substrate carrier 1 and door 15 of the process tool 10, are opened, and the wafers 12 are transported to the process tool 10, as already explained above in connection with FIG. 1.

Here, in contrast to the state of the art, the clamping means 20 engages with the standardized top flange 2 of the wafer carrier which allows that substrate

carriers of different manufacturers are used at the same time in the line.

FIG. 3 illustrates a second embodiment of a device for docking a substrate carrier to a process tool.

According to the second embodiment shown in FIG. 3, the clamping means 20' is attached to the loadport 100 basis and engages with standardized retaining features at the bottom plate 11 of the substrate carrier 1. As may be obtained from FIG. 1, there are different standardized retaining features in the bottom plain of the substrate carrier 1.

FIG. 4 illustrates magnified view of the front door section of the substrate carrier 1 and the process tool 10 of FIGS. 2-3. As shown in more detail in FIG. 4, a hermetic seal 7 in form of a compliant rubber cushion surrounds the front door 8 of the substrate carrier 1. Preferably, the seal 7 is located at the side of the tool 10. Moreover, on the side edges of the front side of the carrier 1, there is a lip 9 around the door 8. Illustrated for convenience is also clamping means 200 used in the prior art; as well as the mentioned latch keys in front door 15 of tool 10.

FIG. 5 illustrates a bottom view of the substrate carrier of the second embodiment shown in FIG. 3.

Particularly, there are two recesses 18 and 19, with which the clamping means 20' can be engaged. Moreover, there are rails 16a, 16b, for the conveying means 50, said rails including holes 17a, 17b into which the clamping means 20' can be inserted.

With regard to said second embodiment it should be noted that clamping at the bottom plate 11 could result in a slanting of the wafer substrate carrier 1 at the

loadport. Thus, in order to prevent such slanting, according to third not illustrated embodiment the clamping means includes two clamping mechanisms, namely one engaging with the top flange 2 and the other one engaging with the bottom plate retaining features 18 and/or 19 and/or 17a and /or 17b.

FIG. 6 illustrates a simplified flow-chart diagram of method 300 for docking a substrate carrier 1 having a case with a front door 8 to a front door 15 of a process tool 10 in a hermetically sealed manner (cf. FIGS. 2-5).

Method 300 comprises the steps of: clamping 310 substrate carrier 1 by using a clamping means 20, 20' at either or both of a top flange 2 and a bottom retaining feature (cf. FIG. 5, 17a, 17b; 18; 19) and moving 320 substrate carrier 1 against process tool 10 (cf. the horizontal arrows in FIGS. 2-3), thereby having interposed seal 7 between substrate carrier 1 and said process tool (10) substrate carrier (1).

Preferably, in clamping step 310, the bottom retaining feature (17a, 17b; 18; 19) has at least one of a bottom recess (18; 19) and a bottom conveyor rail hole (17a, 17b). Preferably, in moving step 320, seal 7 surrounds front door 8 of said substrate carrier 1.

While the invention has been described in terms of particular structures, devices and methods, those of skill in the art will understand based on the description herein that it is not limited merely to such examples and that the full scope of the invention is properly determined by the claims that follow.

Claims

1. A method for docking a substrate carrier (1) to a process tool (10), said substrate carrier (1) comprising a case having a front door (8) to be docked to a front door (15) of said process tool in a hermetically sealed manner by using a clamping means (20, 20') for clamping said substrate carrier (1) and urging it against said process tool (10), and having interposed a seal (7) between said substrate carrier (1) and said process tool (10); and said clamping means (20, 20') clamping said substrate carrier (1) at either or both of a top flange (2) and a bottom retaining feature (17a, 17b; 18; 19).

2. The method according to claim 1, wherein said bottom retaining feature (17a, 17b; 18; 19) comprises at least one of a bottom recess (18; 19) and a bottom conveyor rail hole (17a, 17b).

3. The method according to claim 1, wherein said substrate carrier (1) is for carrying semiconductor wafer substrates (12).

4. The method according to claim 1, wherein said top flange (2) is also used for attaching a lifting means for lifting said substrate carrier (1).

5. The method according to claim 1, wherein said seal (7) surrounds said front door (8) of said substrate carrier (1).

6. A device for docking a substrate carrier (1) to a process tool (10), said substrate carrier (1) comprising a case having a front door (8) to be docked to a front door (15) of said process tool in a hermetically sealed manner, said device comprising a clamping means (20, 20') for clamping said substrate carrier (1) and urging it against said process tool (10), and a seal (7) between said substrate carrier (1) and said process tool (10); said clamping means (20, 20') being designed for clamping said substrate carrier (1) at either or both of a top flange (2) and a bottom retaining feature (17a, 17b; 18; 19).

7. The device according to claim 6, wherein said bottom retaining feature (17a, 17b; 18; 19) comprises at least one of a bottom recess (18; 19) and a bottom conveyor rail hole (17a, 17b).

8. The device according to claim 6, wherein said substrate carrier (1) is for carrying semiconductor wafer substrates (12).

9. The device according to claim 6, wherein said top flange (2) is designed for attaching a lifting means for lifting said substrate carrier (1).

10. The device according to claim 6, wherein said seal (7) surrounds said front door (8) of a process tool (10) loadport.

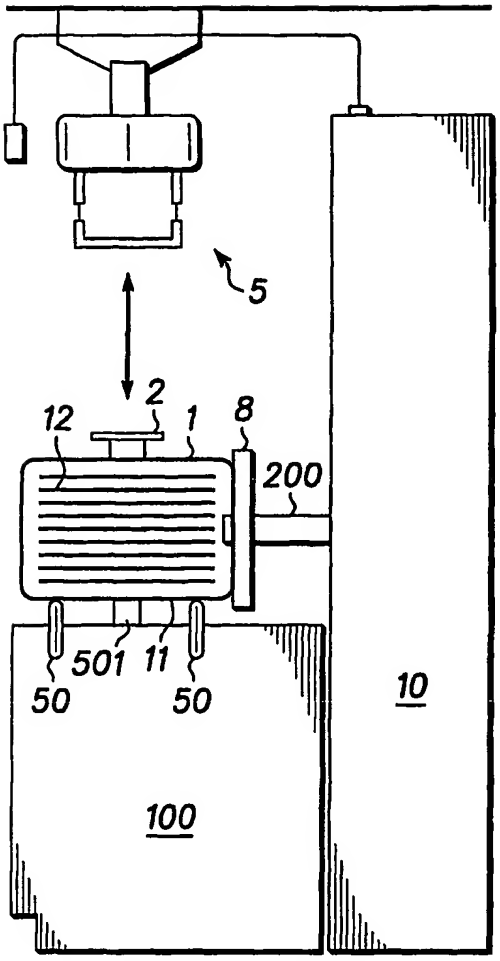
11. A method (300) for docking a substrate carrier (1) having a case with a front door (8) to a front door (12) of a process tool (10) in a hermetically sealed manner, said method comprising the steps of:

clamping (310) said substrate carrier (1) by using a clamping means (20, 20') at either or both of a top flange (2) and a bottom retaining feature (17a, 17b; 18; 19); and

moving (320) said substrate carrier (1) against said process tool (10), thereby having interposed a seal (7) between said substrate carrier (1) and said process tool (10) substrate carrier (1).

12. The method according to claim 11, wherein in said clamping step, said bottom retaining feature (17a, 17b; 18; 19) has at least one of a bottom recess (18; 19) and a bottom conveyor rail hole (17a, 17b).

13. The method according to claim 11, wherein in said moving step (320), said seal (7) surrounds said front door (8) of said substrate carrier (1).



- PRIOR ART -

FIG. 1

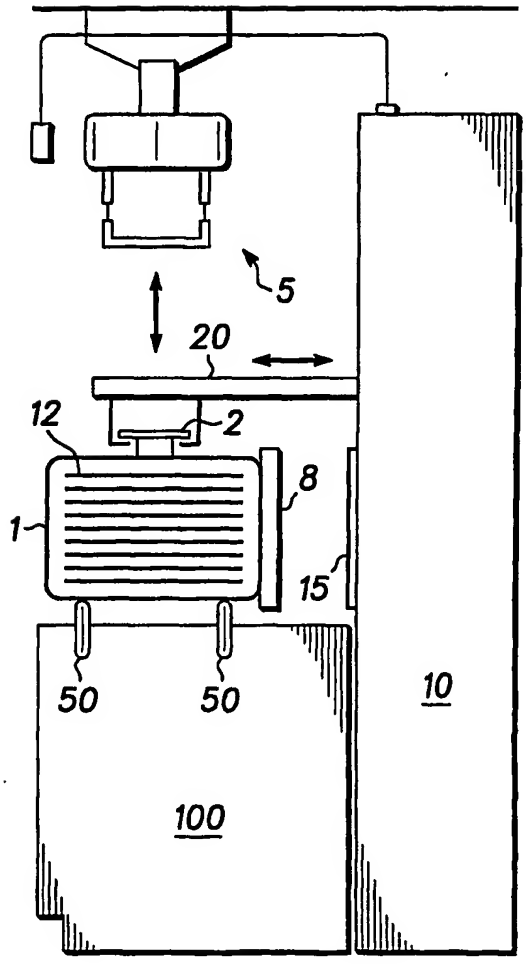


FIG. 2

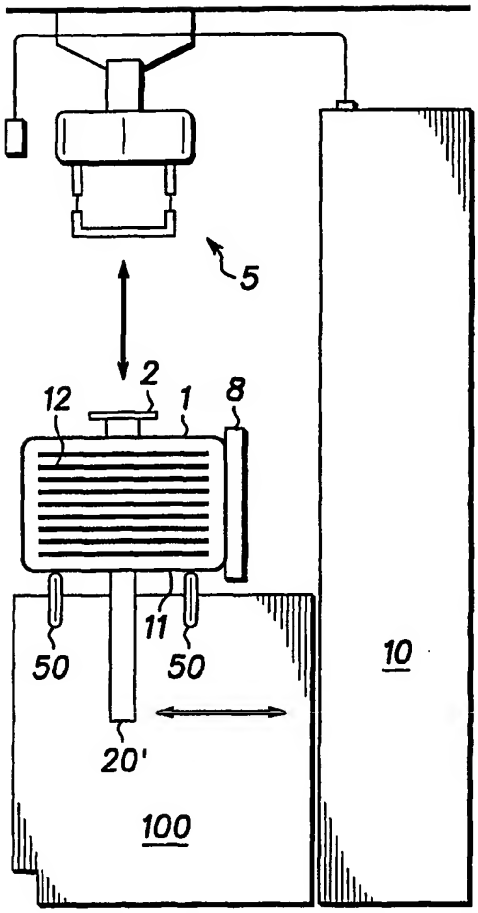


FIG. 3

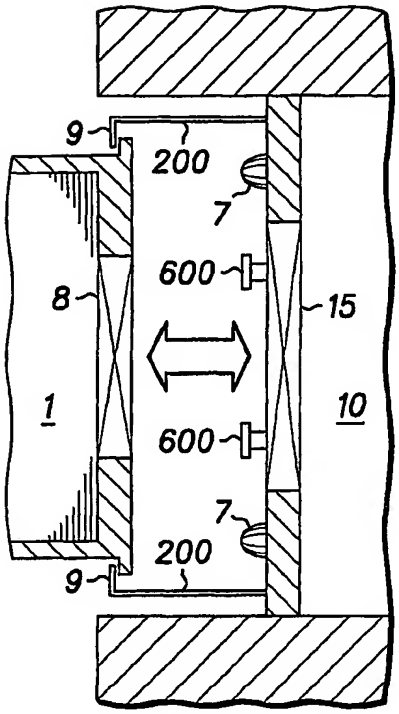


FIG. 4

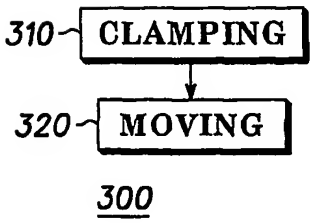


FIG. 6

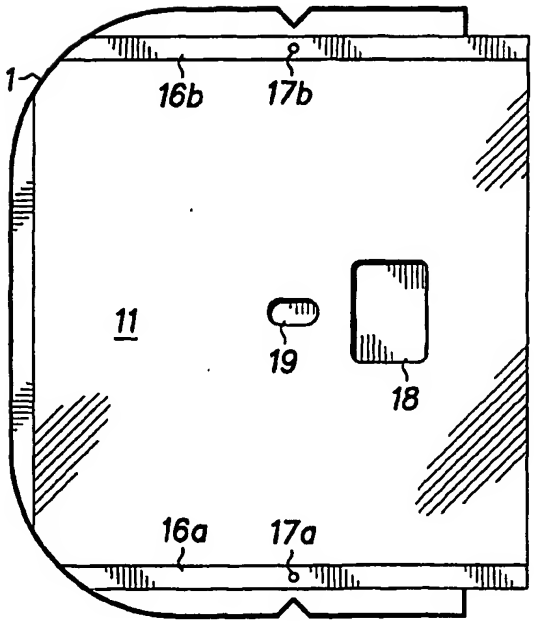


FIG. 5

INTERNATIONAL SEARCH REPORT

Int ›nal Application No
PCT/EP 00/08560

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01L21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 987 750 A (DAINICHI SHOJI K.K.) 22 March 2000 (2000-03-22) abstract; figure 3 column 9, line 10-17 column 9, line 33-37 ---	1-13
X	US 6 013 920 A (GORDON ET AL.) 11 January 2000 (2000-01-11) abstract; figure 2 column 4, line 36-54 ---	1-3,5-8, 10-13
X	WO 99 65803 A (GENMARK AUTOMATION, INC.) 23 December 1999 (1999-12-23) abstract; figures 6,7 page 10, line 14 -page 11, line 5 --- -/--	1-3,5-8, 10-13

[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
18 May 2001	13/06/2001

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/EP 00/08560

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 980 195 A (MIYASHITA) 9 November 1999 (1999-11-09) abstract; figure 6 column 5, line 60 -column 6, line 26	1-3,5-8, 10-13

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INTERNATIONAL SEARCH REPORT

information on patent family members

Int nal Application No
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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 00/08560

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 H01L21/00

Nach der internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 7 H01L

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)
EPO-Internal, WPI Data, PAJ

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	EP 0 987 750 A (DAINICHI SHOJI K.K.) 22. März 2000 (2000-03-22) Zusammenfassung; Abbildung 3 Spalte 9, Zeile 10-17 Spalte 9, Zeile 33-37 ---	1-13
X	US 6 013 920 A (GORDON ET AL.) 11. Januar 2000 (2000-01-11) Zusammenfassung; Abbildung 2 Spalte 4, Zeile 36-54 ---	1-3,5-8, 10-13
X	WO 99 65803 A (GENMARK AUTOMATION, INC.) 23. Dezember 1999 (1999-12-23) Zusammenfassung; Abbildungen 6,7 Seite 10, Zeile 14 -Seite 11, Zeile 5 --- -/--	1-3,5-8, 10-13

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

* Besondere Kategorien von angegebenen Veröffentlichungen :
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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
18. Mai 2001	13/06/2001

Name und Postanschrift der internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Oberle, T

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C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	US 5 980 195 A (MIYASHITA) 9. November 1999 (1999-11-09) Zusammenfassung; Abbildung 6 Spalte 5, Zeile 60 -Spalte 6, Zeile 26	1-3,5-8, 10-13

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen
PCT/EP 00/08560

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